Published in final edited form as:
Soc Sci Med. 2013 April ; 82: 35–42. doi:10.1016/j.socscimed.2013.01.018.

Provider and Patient Influences on the Formation of Socioeconomic Health Behavior Disparities Among Pregnant Women

Elaine M. Hernandez
Population Research Center, The University of Texas at Austin, 305 E. 23rd Street, G1800, Austin, TX 78712

Abstract

Socially advantaged individuals are better positioned to benefit from advances in biomedicine, which frequently results in the emergence of social inequalities in health. I use survey and in-depth interviews with pregnant women and their health care providers from four Midwestern clinics in the United States, conducted in 2009 and 2010. I compare socioeconomic differences in intake of two new prenatal supplements: Vitamin D and omega-3 fatty acid. Although socioeconomic differences in omega-3 fatty acid supplementation emerged, there were no differences in the use of vitamin D. I argue that providers may have contributed to the prevention of a health disparity in vitamin D supplementation by implementing an aggressive uniform protocol. These results suggest that providers not only serve as a conduit for the dissemination of new biomedical information, the strength and uniformity of their recommendations have the potential to prevent or exacerbate socioeconomic differences in health behaviors.

Keywords

health disparities; health care providers; health knowledge; provider-patient interaction; United States

Introduction

On the heels of significant advances in longevity and quality of life, sociologist Charles Kadushin optimistically predicted that as “countries advance in their standard of living, as public sanitation improves, as mass immunization proceeds…the gross factors which intervene between social class and exposure to disease will become more and more equal for all social classes” (1964:75). This optimistic prediction not only failed to come to fruition, over the past decades health disparities in the United States have remained stable or even increased (Elo and Preston 1996; Lauderdale 2001; Marmot 2004; Warren and Hernandez 2007). These trends prompted the U.S. government to develop broad public health goals to eliminate them (U.S. DHHS 2000).

Corresponding author: ehernandez@prc.utexas.edu.

Alleviating such disparities requires that we understand them. An emerging literature (Kenkel 1991; Link et al. 1998; Glied and Lleras-Muney 2008; Chang and Lauderdale 2009) identifies advances in biomedical information or technology as one point when health inequalities begin: Socially advantaged individuals are better positioned to take advantage of new health information. Health care providers serve as one of the main conduits for the translation of such information, which elevates their important role in disseminating information about advances in biomedicine and updating treatment protocol. Thus, what role do providers play in the formation of socioeconomic disparities in health behaviors?

I provide empirical evidence of the formation of a health behavior disparity, while paying particular attention to the role played by health care providers. Using data from a mixed-method study that focuses on a specific case study—women who are pregnant for the first time, or prima gravida women—I explore women's use of two new prenatal supplements, omega-3 fatty acid (O3FA) and vitamin D. Socioeconomic differences in consumption emerged for the first supplement, but not the second.

I argue that the strength and uniformity of providers' recommendations, as well as individual differences between patients, may have played a role in these outcomes. Providers uniformly tested all patients' vitamin D levels and recommended supplementation regardless of socioeconomic status (SES). In contrast, their recommendations for O3FA supplementation varied, and they were less inclined to recommend it to women with a lower SES because they perceived it to be unaffordable. Additionally, women with a higher SES were more likely to seek out and adhere to recommendations about supplements outside of their prenatal appointments. Combined, these processes may have contributed to the formation of a socioeconomic gradient in O3FA supplementation among pregnant women, but not vitamin D. These results emphasize the need to understand how the dissemination of new health information through clinic-level protocol and provider/patient behavior is associated with socioeconomic differences in health behaviors.

Background

Advances in Biomedicine and the Formation or Prevention of Health Disparities

To identify the origins of socioeconomic disparities in health, researchers are building on the notion that advances in biomedicine will disproportionately benefit socioeconomically advantaged individuals (Link and Phelan 1995; Link et al. 1998; Gortmaker and Wise 1997; Glied and Lleras-Muney 2008; Chang and Lauderdale 2009). These individuals are better situated to avoid health hazards when new health information or advances in biomedical technology become available, and over time socioeconomic differences in health behaviors develop.

The evolution of a socioeconomic gradient in smoking behavior provides a prime example. Following the U.S. Surgeon General's warning about the risks of smoking cigarettes, well-educated individuals were more likely to quit and less likely to start smoking in the ensuing decades (Kenkel 1991, 2007). Individual differences in knowledge about smoking hazards account for a portion, but not all, of this gradient (Kenkel 1991). Socioeconomic gradients in breast and cervical cancer screening also emerged as people with higher education and income levels were more inclined to utilize such preventive procedures (Link et al. 1998). Similarly, technological advances in screening and treatment have resulted in larger socioeconomic gradients in cancer mortality and survivorship for those that have a higher survival rate, compared to those that are not preventable (Kogevinas and Porta 1997; Glied and Lleras-Muney 2008; Miech et al. 2011).

Observing these consequences of advances or innovations in biomedicine offers a vantage point to understand how health inequalities begin. But such advances or innovations need not always result in health inequalities, as Goldman and Lakdawalla (2005) provide evidence that two outcomes are possible. Socially advantaged people may disproportionately benefit from an innovation in health care, creating or exacerbating health disparities. Alternatively, an innovation that simplifies individual efforts, and is available to everyone, may cause health disparities to "contract" or prevent their formation. Goldman and Lakdawalla (2005), for instance, provide evidence that a simpler hypertension drug regimen was associated with a "contraction" in cardiovascular disparities.

The Role of Health Care Providers

Health care providers play a pivotal role as a conduit for the diffusion of new biomedical information when they translate it into professional recommendations (Lehoux et al. 2010). A separate line of inquiry has established that providers can play a role in the formation of socioeconomic and racial/ethnic disparities in health. In combination, this research suggests that health care providers may play a role in the formation or prevention of socioeconomic disparities in health behaviors based on new biomedical information.

The patient-provider interaction is often of primary importance for decisions about new health behaviors, especially those based on new health information. Providers play a key role providing health information (Hoffman et al. 2010), swaying medical decisions (Pescosolido 1992; Heritage and Maynard 2006), and influencing adherence to a range of medical approaches (Boyer and Lutfey 2010; Osterberg and Blaschke 2011). At times providers' racial/ethnic expectations or biases may also inadvertently contribute to health disparities (Smedley et al. 2002; van Ryn and Fu 2003), as well as their moral evaluation of patient's attributes (Roth 1972). Most pertinent for this research, providers' perceptions of their patients (van Ryn and Burke 2000) and expectations about their patient's probability or ability to adhere to treatment may be affected by their explicit or implicit socioeconomic biases (Lutfey and Freese 2005).

Lutfey and Freese (2005) argue that socioeconomic status operates through proximate mechanisms at the clinic-level to contribute to differences in health behaviors. They found that physicians assessed higher-SES patients to be more motivated in their diabetes treatment: Even though poorer patients more frequently skipped appointments because the personal costs were greater for them, physicians commonly ignored these external factors and inferred a lack of compliance. In turn, physicians taught a more sophisticated regimen of diabetes treatment to patients they perceived to be more compliant. Although their data and method preclude population-level assessments, their study—as well as the literature on the importance of the patient-provider interaction (i.e., van Ryn and Burke 2000; van Ryn and Fu 2003)—supports the notion that providers play an important role in the emergence of health-related disparities.

Health Behaviors Among Women Pregnant for the First Time

I focus on a specific empirical example: consumption of two new prenatal supplements among prima gravida women, which is ideal because they encounter new pregnancy information for the first time. The supplements—vitamin D and omega-3 fatty acid (O3FA)—are also a prime example of new biomedical information and have only recently been recommended as prenatal supplements. Maternal consumption of vitamin D during pregnancy (beyond the standard prenatal supplement of 400 IU; Hollis and Wagner 2004), promotes intrauterine bone growth, may prevent future osteoporotic fracture, and it is associated with a reduced chance of developing antibodies associated with diabetes and asthma symptoms (Javaid et al. 2006; Holick 2007). Prenatal consumption of O3FA aids

brain and eye development of the fetus (SanGiovanni et al. 2000; Sheila 2008), but they may also be beneficial for hypertensive disorders during pregnancy (e.g., preeclampsia), metabolic concerns of children, and prevention of postpartum depression (Genuis and Schwalfenberg 2006).

My first aim is to employ quantitative data from a new survey to test whether women's SES is associated with supplementation, while accounting for individual-level knowledge and clinic-level differences in supplement protocol. This approach merges two strands of research, one which focuses on advances in biomedicine as catalysts for the emergence of health disparities, and the other which concentrates on the role of providers in the formation of health disparities. Building on the first, I anticipate that socially advantaged women will be more likely to both understand the benefits of these supplements and consume them. Attending to the second, I then focus on clinic-level differences in supplement protocol as well as individual provider recommendations. Providers at one of the four participating clinics aggressively recommended vitamin D supplements, a difference which allows me to test whether patients were more inclined to adhere to stronger recommendations. Finally, I use qualitative data to explore how providers' individual interactions with women influenced their health decisions, in particular providers' expectations about their patient's propensity to consume the supplements. A conceptual framework of these individual, clinic, and health care provider factors is depicted in Figure 1.

Methods

Study Design

My study combines a quantitative component and two qualitative components. Women were sequentially enrolled from four health clinics (i.e., termed the Red, Orange, Yellow and Green Clinics for participant anonymity) in two Midwestern cities over the course of thirteen months (November 2009–November 2010). English-speaking prima gravida women over the age of 18 and under 27 weeks pregnant (to ensure participation among those who lacked access to early prenatal care) were eligible. Pregnancy intention did not matter, and they also qualified for the study if they previously had an elected or spontaneous abortion (essential prima gravida). The appropriate ethics boards provided approval for this study, and participants' informed consent was received.

Women completed a 20-minute survey interview designed for this study, the Health Information and Behaviors During Pregnancy Study (HIBPS) questionnaire (reviewed by three obstetricians and pre-tested on 30 women from the clinics). Approximately 68 percent of eligible women participated in-person (85 percent), or by phone (15 percent), yielding an enrollment of 225. All surveys were administered by trained survey interviewers.

Each month, I stratified enrollees into three education groups and selected a random subset of two from each strata to participate in in-depth semi-structured interviews at the beginning of their third trimester (between weeks 28 and 30), resulting in 41 in-depth interviews. I then conducted 14 in-depth interviews with health care providers (physicians, midwives, and nurses) who provided care for five or more survey participants.

Survey Interviews

Measures—Understanding how people react to new health information is a key goal of this study, so I operationalize SES as educational attainment. Education is an important marker because it may help people to develop cognitive skills that would enable them to understand and act upon new health information (Rosenzweig 1995; Mirowsky and Ross 2003; Cutler and Lleras-Muney 2010). Methodologically, it is an ideal measure of SES for a

number of reasons (Hummer and Lariscy 2011): 1) in most instances, schooling ends in the beginning of adulthood and does not change; 2) it is a stable measure of SES regardless of employment status; and, 3) it precedes, and often directly impacts, other measures of SES such as income and occupation, thus reducing the impacts of health-related endogeneity.

Rather than focusing solely on women's educational attainment, I account for the complexity of their linked lives during pregnancy by conceptualizing educational attainment at the couple-level (Moen and Hernandez 2009). During the in-depth interviews, women reported that their decisions were influenced by their partners who frequently attended their prenatal appointments, discussed the supplement with them, and/or reminded them to consume it.

The HIBPS questionnaire includes an education question from the 2009 National Health Interview Survey (NCHS 2009), which I also modified to ascertain their partner's education-level (if they were in a relationship). The couple-level measure of education represents the highest educational degree between the couple (coded as dummy measures): less than a bachelor's degree, Bachelor's degree, and graduate degree. These categories compose higher levels than what is typically used in related research, but they reflect the relatively high education-levels among women who visited the four participating clinics. Sensitivity analysis revealed similar results using a continuous measure of education at the individual- and couple-levels.

The measures of vitamin D and O3FA consumption and knowledge were adapted from questions included on the Pregnancy Risk Assessment Monitoring System (PRAMS; Gilbert et al. 1999) study questionnaire. For supplement consumption I asked (supplement consumption = 1; no consumption = 0): "[d]uring the past month, have you taken [a vitamin D supplement/any fish oil or flaxseed supplements]? Do not count your prenatal vitamin." For O3FA health knowledge: "Some health experts recommend consuming O3FAs during pregnancy for which of the following reasons? (to help with brain development [correct]; to help prevent a premature delivery; and, to help women sleep well)." Women were asked the accuracy of each response option, which I used to create an index ranging from 0 (low) to 3 (high). For vitamin D health knowledge, I asked a question with an open-ended response option because of the wider range of health benefits. Women were coded as having knowledge (knowledge = 1; no knowledge = 0) if they correctly identified at least one benefit of vitamin D supplements based on a recent review of the literature (Holick 2007) (i.e., bone development or calcium absorption (n = 44), immunity (n = 2), cancer prevention (n = 2), or a deficiency due to lack of sunshine (n = 20)). Because vitamin D is a new prenatal supplement, the knowledge question was added four months after the study began. To preserve cases, I include a dummy variable to indicate if women's health knowledge was tested.

I also include a variable to indicate whether the patient utilized care at the Orange Clinic. As I describe below, this dichotomy represents clinic-level differences in the strength and uniformity of protocol. Because the cost of supplements may be inhibitory, I account for poverty using a measure based upon the U.S. Bureau of the Census 2010 Poverty Threshold (2010) for people under 65 in one or two person households (depending on relationship status) with no children. I use a conservative estimate based upon double the 2010 poverty thresholds ($29,204 for two- and $22,688 for one-person households).

All models also include four demographic characteristics that may also be associated with supplementation. Age is coded as a continuous variable, but race (white = 1; non-white = 0) and ethnicity (Hispanic = 1; non-Hispanic = 0) are coded as dichotomous variables.

Although 65 percent were under 20 weeks pregnant, I also include a measure of the number of weeks pregnant women were at the time of the survey.

In-Depth Semi-Structured Interviews

In-depth interviews with women lasted between 50 and 75 minutes. The interview was guided by questions from the survey interview, but women were able to elaborate and provide rich detail about their decision-making processes. Women chose the location for their in-depth interviews (e.g., their home), which afforded privacy and enabled them to answer in more detail. In-depth interviews with obstetricians, midwives and nurses lasted between 20 and 45 minutes, and took place in the clinics. Each provider was specifically asked about the information and advice they provided to pregnant patients during a first trimester prenatal appointment, but interviews were not linked to specific patients to preserve confidentiality. In-depth interviews were transcribed a short time after being conducted and themes that emerged were content-coded using Atlas.ti version 6 (Loflan et al. 2006).

Analysis

I begin by estimating the likelihood of each health behavior using logistic regression, while controlling for basic demographic characteristics. Next, I account for individual knowledge about the supplements, allowing me to test whether educational differences are due to differential knowledge across women. Finally, I control for poverty status and clinic to assess whether income or type of provider recommendations are associated with intake. To explore the role of health care providers, I use results from in-depth interviews with women and their providers. Triangulating these provides a nuanced illustration of the discussions that occurred within during prenatal appointments. Moreover, I also explore providers' motivations for making recommendations as well as patients' decision-making processes.

Results

Education, Health Knowledge, Clinic Protocol, and Supplement Intake

Survey Interview Results—Approximately 34 percent and 42 percent of women consumed an O3FA and vitamin D supplement, respectively (see Table 1). Auxiliary analysis (not shown) revealed minimal differences in vitamin D intake levels by month in study or season, suggesting consistency in the vitamin D protocol and intake. The average O3FA knowledge score was 2.0 out of 3, and among those asked the question, half named at least one benefit of prenatal vitamin D consumption. About 55 percent of women or their partners had completed a graduate degree, 32 percent a bachelor's degree and 13 percent less than a bachelor's degree. On average, women were 30 years old, partnered (94 percent), and white (73 percent); just five percent were Hispanic. Women were about 18.8 weeks pregnant. Due to issues of access as well as variation in the proportion of prima gravida women visiting each clinic, 76 percent of patients enrolled received care at the Orange Clinic.

Does supplement intake differ by education-level? In Table 2, I show results from the logistic regression analysis for O3FA consumption and vitamin D consumption, respectively. If women or their partners possessed a graduate degree they were more inclined to consume an O3FA supplement, but there were no educational differences in vitamin D supplement intake. More specifically, if women or their partners had completed a master's, professional or doctoral degree they had about four times the odds of consuming an O3FA supplement compared to couples where neither member had completed college.

To what extent do individual-level differences in health knowledge about the supplements or poverty account for the association between education and O3FA consumption? Women who identified the benefits of O3FA supplements during pregnancy were significantly more likely to consume one. Yet, accounting for individual health knowledge only partially attenuated the educational disparity in intake; if women or their partners possessed a graduate degree they still had more than three times the odds of consuming the supplement. A formal test of mediation (not shown; Kenny 2008) revealed that individual knowledge about O3FA supplements accounted for approximately 14% of the association; this result was significant at the $p < 0.10$ level. In Model 3a, I include a measure of poverty, which was not significantly associated with intake of O3FA intake. Even though education was not associated with vitamin D intake, individual vitamin D knowledge did matter: If women could correctly identify a benefit of vitamin D supplements, they exhibited significantly greater odds of consuming one.

Do different clinic-level protocol for provider recommendations influence patient supplement intake? As described below, Orange Clinic patients were more inclined to have their vitamin D levels tested, and they received a strong recommendation to consume a supplement if their level was low. These Orange Clinic patients exhibited over four times the odds of consuming the supplement compared to those who received their care elsewhere. Orange Clinic providers had also implemented a weak protocol to recommend O3FA supplementation, which nearly doubled the odds that women consumed a supplement compared to others. Next, I turn to results from the in-depth interviews to provide a more detailed and nuanced illustration of the role of health care providers as well as other factors that may have led to educational differences in health behaviors.

The Role of Health Care Providers: In-Depth Interview Results

Vitamin D: Clinic Level Differences in Strength and Uniformity of Protocol—

Information about vitamin D supplementation first reached the Orange Clinic via one of the nurse midwives who received an email from a physician in 2009. After studying the evidence, the Orange Clinic providers decided to test patients' vitamin D levels, which spread to pregnant patients in the fall of 2009. Therefore, just prior to the start of this study the Orange Clinic began a protocol of *uniformly* testing all women's vitamin D levels after their first prenatal visit. Some obstetricians and midwives rotated through the Red Clinic, and followed the Orange Clinic protocol when caring for patients, but the other Red Clinic staff did not adopt the more aggressive protocol. Both the Orange and Red Clinics specialize in obstetric and gynecologic care, but the Orange Clinic patient population includes more obstetric patients than the Red Clinic. This specialization in obstetrics care provides some insight about why the Orange Clinic adopted a stronger, uniform protocol in this instance. This protocol resulted in *strong* recommendations for vitamin D supplementation among Orange Clinic patients compared to other patients who were not uniformly screened.

Unless their level fell within a high target range of 50–80 ng/ML—designated by the staff and not set forth by any medical association or government entity—Orange Clinic patients received a recommendation to consume a vitamin D supplement (approximately 1,000 or 2,000 IU) in addition to their prenatal supplement (which most often contained a smaller dose of vitamin D). During their initial visit, a nurse told these patients that they were particularly predisposed to have low levels of vitamin D because they lived at a high latitude and discussed benefits of the "sunshine hormone:"

> Studies have shown that most women in our state are deficient in vitamin D…It's actually a hormone and it's …very significant in the baby's development and the health of the mother from a cardiovascular standpoint and many other body systems, mental state; all kinds of areas where vitamin D makes a big difference.

> And we don't get enough sun here in [this Midwestern state] and then we put sunscreen on so we're just not soaking up enough vitamin D… I think it's fairly new, all these studies …But it's also been proven that there's no bad effect from taking it at this point, so that's why we're recommending it.

Women were seen by a midwife or obstetrician during their second appointment, at which point they received a second recommendation for vitamin D, unless their level was unusually high. As one midwife describes, vitamin D deficiency is another diagnosis:

> I say, 'You know what? You get another diagnosis. Like many [people in this Midwestern state], you are very vitamin D deficient. And we're just learning how important this vitamin that's really a hormone, is. This is our sunshine hormone. Here's some information,' and I give them the handout. 'Read about it. Let me know if you have questions about it.' And then each visit I say, "what are you taking? Are you taking your vitamins and vitamin D?' The message of 'this is going to be a lifetime thing' or 'as long as you live [here].'

These two quotes demonstrate that providers were educating women about vitamin D and repeatedly inquiring about their intake. Providers reported that women were often screened a second time during their second trimester if they had a very low level. Of note, providers often mentioned that there were no consequential negative effects or risks associated with consumption.

Unlike the Orange Clinic providers, those at other clinics *did not uniformly* screen all patients, *nor did they strongly recommend* the vitamin D supplement. In fact, one nurse, who conducted the initial prenatal visits at a different clinic, described vitamin D as the current "vitamin of choice:"

> I think that vitamin D, right now, is the vitamin of choice. It's within the last several years that everyone's worried about vitamin D…Now you'll see patients who have their vitamin D levels drawn in the lab. Five years ago you would never had seen that. So you don't see the levels drawn very often for pregnant women. My guess is that it's somebody who has, who's inquired about it. And I've only seen it once [among patients in this clinic].

Within this clinic, women were only screened for a vitamin D deficiency if they had taken the initiative to request the test. Providers rarely discussed the vitamin with patients, resulting in very few recommendations.

If prescribed, by and large patients followed their providers' recommendations. Orange Clinic patients frequently reported that they were consuming the vitamin *because their health care provider had recommended it.* When asked about her vitamin D consumption, one college-educated Orange Clinic patient repeated her midwife's advice, using very similar language:

> Yes, I do [take the vitamin]…I think after my first visit to the nurse, they had to draw a blood sample and they say, 'Well, your vitamin D level's a little low but it's very common among [women in this region of the country].' I was thinking, 'I'm not [from here],' but they say, 'Well, you live here for the past couple years and it's mostly due to the fact that you didn't get enough sunlight during wintertime. In addition to the prenatal vitamins, you should take vitamin D,' so yes, and I'm taking…I think the tablet that I'm taking per day has about 5000 IU.

Even if they were unable to explain *why* they were prescribed the supplement Orange Clinic patients followed their providers' advice. Conversely, vitamin D was not a frequent topic among those seen at other clinics:

> *Q*: And how about a vitamin D supplement? You're not taking that?
>
> No.
>
> *Q*: Were you tested for that?
>
> If I was, it was way back in [my early pregnancy]. Otherwise, I don't. They tested me for like a whole bunch of things… when they first found out I was pregnant… but I haven't really talked about it with any doctors so I don't really think I got tested for it.

Although the patient—who was college-educated—had some knowledge about vitamin D, she did not recall discussing during appointments, and did not take the supplement.

Providers and their patients also identified a number of impediments, which varied by clinic. They most frequently mentioned lack of awareness about vitamin D as the primary impediment. Results from the in-depth interviews confirm that there were not education differences in awareness about or consumption of the supplement, and nearly every Orange Clinic patient was aware of vitamin D supplements. Although a few women reported reading about it outside of their appointment, most women learned that it was an "important supplement" from their provider, even if they could not explain why. This high vitamin D awareness is a further testament to the success of the Orange Clinic providers in educating women and aggressively recommending it.

O3FA: Clinic and Provider Level Differences in Strength and Uniformity of Protocol—Prior to recommending vitamin D, Orange Clinic providers had already begun recommending O3FA supplements during pregnancy, primarily for brain development of the fetus. The chair of the Orange Clinic was instrumental in implementing the recommendation of a plant-based version of the supplement to avoid potential contamination with mercury in fish-based versions. No standard blood tests exist to determine O3FA levels, and as one health care provider in the Orange Clinic noted: "We don't have like a standing order or a process [like the strong protocol for recommending vitamin D] that says these are the medicines that you really [should recommend]."

The Orange Clinic providers did not have a standard protocol for recommending O3FA supplementation, which resulted in an overall *weak and uneven protocol*. Some women began consuming one prior to their first prenatal visit, but the intake nurses at the Orange Clinic provided only a portion of the remainder with information about it:

> Some days it does [come up], some days it doesn't! It depends on the patient. The patients who do not…have very low incomes are not going to do that.…They can't afford the prenatal vitamin. So I'm focusing on getting a prenatal vitamin into them. The other ones I'm not.

This response, and concern about the financial burden of the supplement, was echoed in additional interviews with midwives. Likewise, during later appointments with midwives the supplement was not recommended uniformly, as one midwife at the Orange Clinic described,

> [O3FAs are] the one that I tend to leave out.
>
> *Q:* Okay. So when you say that you don't talk about the fish oil or flax seed, why is that?
>
> I think I just have not got it into our material. It's not because I don't think it's important. And I try. But that's usually what gets forgotten.

Not all providers voiced the same concerns about income, though, and one uniformly recommended it to all women. When asked if cost was an impediment, one obstetrician at the Orange Clinic mentioned that health insurance companies—including the state run Medicaid program—will pay for the supplement:

> *Q*: Do you ever run across women who are concerned about the cost of the supplement?
>
> Yes, but not really. Either their insurance covers it or we can. So generally, our low income population is on [the state Medicaid program], and that will cover it. Or, if they buy it over the counter…they're just happy to do it for their health and their baby's health.

Even so, uniformly recommending O3FA supplements was the exception rather than the rule. Notably, no woman mentioned cost as a factor preventing them from taking either supplement.

With a weak, uneven protocol in place, Orange Clinic providers discussed it more often with women who brought it up during the prenatal appointment, as voiced by one midwife:

> You know, I would recommend it to anybody who asks about it because it's not harmful and it has many benefits. And anything that's not harmful and has many benefits you can't help but recommend. But I would say that comes up a lot less frequently. People don't ask about it as much.

Although they did not have any specific protocol (weak or strong), providers outside of the Orange Clinic also reported some discussions with patients, primarily with those who were more assertive about the supplement. As one nurse who provided care outside of the Orange Clinic described,

> Once in a while, you'll see in our patients that they're asking about fish oil. And the only thing I've ever seen is a recommendation that if that's something that they want, then they certainly could take that. That's usually what the physician recommends.

This variation in patient-provider discussions about O3FAs resulted in overall piecemeal recommendations for O3FA within all clinics.

Among patients from all clinics awareness varied, as about one in five women were not aware of the supplement and there was little clinic-level variation in knowledge. In contrast to vitamin D supplements, women frequently learned about O3FAs *outside* of their prenatal appointment through pregnancy web sites or books, or conversations with other people. Providers, including one Orange Clinic midwife, frequently noted that they began to anticipate this "type" of patient:

> [They are] [t]he same kind that's probably already read a whole book about pregnancy by the eighth week! That woman lets on by your conversation with her. She'll say, "oh, I read this on the internet," or "I heard about this," or "my friend told me this."

Affirming the survey results, the in-depth interview results suggested that women with a college or graduate degree were more inclined to both understand the benefits of the supplement and consume it.

Not all women who were knowledgeable about the supplement consumed it, though, as some were less inclined to consume it precisely because of its novelty. One patient seen outside of the Orange Clinic, who had not completed college, described her concerns about

the strength of the supplement after overhearing conversations between physicians and pharmacists:

> [S]ome [physicians or pharmacists] think that it can be detrimental because it can be too much too fast and some people think that it's essential and that kids won't develop correctly without it. So I just kind of took the middle road and said, well, you know, because I don't like fish but I can suck it up. I can have some tuna fish every once in a while and go the natural route and do that.
>
> *Q*: So when they said "too much too fast," they just mean too much of the omega-3s or…
>
> I think they meant…the supplements are too strong for…like it's fine for an adult but they don't know what the concentration is getting to the fetus, so I think they were kind of proponents of more research on that before they make it a guideline type of a thing.
>
> *Q*: And do you know why it's important to take that during pregnancy?
>
> Brain and eye and heart and all that kind of development, I'm guessing.

Even though this woman recognized the benefits of O3FA supplementation, she was more cautious and avoided the supplement in favor of consuming fish for O3FAs. Of note, this woman was listening to—and basing her decision upon—providers' opinions, albeit not her own midwife's opinions.

Other impediments reported by women and their providers included side effects, and, as mentioned, a desire to obtain the necessary nutrients through other methods. Occasionally, women reported that the fish oil version of the O3FA supplement sometimes caused unpleasant side effects, such as "fish burps." A small number of well-educated women were averse to consuming any additional supplements, and sought to supplement their intake through additional exposure to the sun and foods rich in O3FAs. Although small, these anti-supplement women may have acquired O3FAs through their diet, which would lead the current survey interview estimates to be conservative.

Discussion

In spite of significant advances in health and longevity over the past century, health disparities have remained persistent (Warren and Hernandez 2007). Understanding how they begin provides a useful vantage point to intervene. This study builds on an emerging approach that emphasizes that advances in biomedicine may precipitate the formation of disparities in health behaviors and outcomes (Gortmaker and Wise 1997; Glied and Lleras-Muney 2008; Chang and Lauderdale 2009), and merges it with evidence of the role that health care providers play in influencing patient decisions (van Ryn and Burke 2000; Lutfey et al. 2010; Osterberg and Blaschke 2011).

To assess the influence of patient, provider, and clinic-level factors on the formation or prevention of socioeconomic differences in health behaviors, I use data from a mixed-method study. This rich data source not only provides information about socioeconomic differences in intake of two novel prenatal supplements, it offers a nuanced illustration of the information exchanged and influences provided during prenatal appointments. I argue that these factors form a constellation of proximate mechanisms that influence women's prenatal decisions.

Providers in the main clinic that participated in the study implemented a weak and uneven protocol to recommend O3FA prenatal supplements due to availability of screening tests, as

well as concerns about some patient's ability to afford them. These providers implemented a more aggressive and uniform protocol for vitamin D supplements. Survey interview results confirm that more highly educated women had greater odds of consuming the O3FA supplements, but there were no differences in vitamin D intake. Combined, individual differences in knowledge about O3FAs, poverty status, and clinic protocol (weak vs. none), partially attenuated the disparity. If women understood about the benefits they were more inclined to take a vitamin D supplement, but they were considerably more likely to take it if their clinic had a strong vitamin D protocol, compared to no protocol.

In-depth interviews with women and their providers afford a more nuanced elucidation of these factors at play. Overall, women reported that they followed their providers' advice, elevating the importance of both clinic-level protocol and as individual provider recommendations. At times, providers also reported that they based their recommendations on perceived ability to afford the supplement, which resulted in fewer recommendations for lower SES women. Factors outside of prenatal appointments also contributed to the emergence of a gradient in O3FA supplementation, as highly educated women sought additional information about the supplements. Thus, inconsistent provider recommendations and differences in patient information seeking behavior contributed to education-level differences in O3FA supplementation.

These results provide evidence that the diffusion of new medical information at the clinic-level may have unplanned consequences for the formation of health behavior disparities. Yet, the fact that there were educational differences in intake of only one supplement provides evidence that new biomedical practices do not necessarily result in *negative* consequences. Rather, the uniformity of the clinic-level vitamin D protocol may represent an innovation that simplified patient-level effort, resulting in a contraction (Goldman and Lakdawalla 2005) or the potential prevention of educational differences in a health behavior.

Although the data provide a unique perspective of the emergence of educational differences in supplement intake, they are not without limitations. First, the study includes prima gravida women from two Midwestern cities; thus, it is beyond the scope of this research to make generalizations to the broader U.S. population. Second, although I am able to employ clinic-level differences in vitamin D protocols, the same differences did not exist for O3FA. Moreover, I am not able to make comparisons between clinics with strong, limited or no protocol to test whether disparities are more likely to form *for the same type of supplement*. Fourth, it is possible that women consumed sufficient amounts of vitamin D through their prenatal vitamin, and I lacked access to their health records to determine their vitamin D levels. However, recent evidence suggests that prenatal supplements do not provide enough vitamin D for the majority of pregnant women (Holick 2007). Finally, based upon the current evidence, these supplements provide arguably fewer benefits compared to other pregnancy behaviors (e.g., smoking cessation). In spite of their relatively modest public health benefits, though, these examples provide a window into the potential consequences of advances in biomedicine as well as the important role that providers play in translating research findings and promoting new health behaviors.

Researchers from a variety of fields describe the formation of health disparities as one inadvertent consequence of biomedical advances (Gortmaker and Wise 1997; Glied and Lleras-Muney 2008; Miech 2008; Chang and Lauderdale 2009). Building on this approach, I argue that providers not only serve as a conduit for the translation and dissemination of cutting edge findings, the strength and uniformity of their recommendations may have the potential to prevent or exacerbate the formation of inequalities in specific health behaviors. I found that, although individual-level knowledge was important, when providers gave strong

and uniform recommendations there were no educational differences in consumption of a *new* supplement.

Similarly, Harper and colleagues (2008) found that states that enforce stricter seat belt laws have smaller socioeconomic gradients in seat belt use compared to those that enforce more lenient laws. These results suggest that implementing more uniform protocols may reduce SES-health behavior disparities due to patients' ability to access and understand new health information *and/or* providers' expectations about their patients' ability to comply. Needless to say, these results elevate the need for future research that considers how health care providers disseminate new health information and design new protocols for treatment. Designing thoughtful, carefully planned clinic protocols may prevent or alleviate the formation of disparities in health behaviors.

Acknowledgments

I am very grateful to John Robert Warren, Phyllis Moen, Bernice Pescosolido, Robert Hummer, J. Michael Oakes, David Knoke, Michael Davern, Andrew Halpern-Manners, as well as the anonymous reviewers for their assistance and feedback on various aspects of this research. This research has been supported by the Department of Sociology, the Children, Youth and Family Consortium, and the Graduate School at the University of Minnesota as well as the Foundation for Informed Medical Decision Making, the American Sociological Association, the National Science Foundation (#SES-1002794), and a postdoctoral National Research Service Award from the National Institute of Child Health and Human Development (#1 F32 HD070595-01). I am indebted to Laura Cudzilo, Victoria Dutcher, Melissa Fousek, Molly Laney, Krista Reagan, Sarah Simpson, Jane van Dis and Remy Wong for their research assistance, advice about the medical accuracy of this study, and transcription as well as the anonymous staff at four health care clinics.

References

Boyer C, Lutfey K. Examining Critical Health Policy Issues within and beyond the Clinical Encounter: Patient-Provider Relationships and Help-seeking Behavior. Journal of Health and Social Behavior. 2010; 51(S):S80–S93. [PubMed: 20943585]

Chang V, Lauderdale D. Fundamental Cause Theory, Technological Innovation, and Health Disparities: The Case of Cholesterol in the Era of Statins. Journal of Health and Social Behavior. 2009; 50(3):245–260. [PubMed: 19711804]

Elo I, Preston S. Educational differentials in mortality in the United States 1979–1985. Social Science & Medicine. 1996; 42(1):47–57. [PubMed: 8745107]

Genuis S, Schwalfenberg G. Time for an oil check: the role of essential omega-3 fatty acids in maternal and pediatric health. Journal of Perinatology. 2006; 26(6):359–365. [PubMed: 16688204]

Goldman, Dana P.; Lakdawalla, Darius N. A Theory of Health Disparities and Medical Technology. Contributions to Economic Analysis and Policy. 2005; 4(1):1–30.

Gilbert B, Shulman H, Fischer L, Rogers M. The Pregnancy Risk Assessment Monitoring System (PRAMS): Methods and 1996 Response Rates from 11 States. Maternal and Child Health Journal. 1999; 3(4):199–209. [PubMed: 10791360]

Glied S, Lleras-Muney A. Technological Innovation and Inequality in Health. Demography. 2008; 45(3):741–761. [PubMed: 18939670]

Harper S, Erin C, Strumpf Burris S, Smith G, Lynch L. Do Mandatory Seat Belt Laws Affect Socioeconomic Inequalities in Seat Belt Use? Working paper. 2008

Heritage J, Maynard D. Problems and Prospects in the Study of Physician-Patient Interaction: 30 Years of Research. Annual Review of Sociology. 2006; 32:351–74.

Hoffman R, Lewis C, Pignone M, Couper M, Barry M, Elmore J, Levin C, Van Hoewyk J, Zikmund-Fisher B. Decision-Making Processes for Breast, Colorectal, and Prostate Cancer Screenings: The DECISIONS Survey. Medical Decision Making. 2010; 30(5):53S–64S. [PubMed: 20881154]

Holick M. Vitamin D Deficiency. The New England Journal of Medicine. 2007; 357:266–81. [PubMed: 17634462]

Hollis B, Wagner C. Assessment of dietary vitamin D requirements during pregnancy and lactation. American Journal of Clinical Nutrition. 2004; 79(5):717–26. [PubMed: 15113709]

Hummer, R.; Lariscy, J. Educational Attainment and Adult Mortality. In: Rogers, RG.; Crimmins, E., editors. International Handbook of Adult Mortality. New York: Springer Publishers; 2011. p. 241-262.

Javaid M, Crozier S, Harvey N, Gale R, Dennison E, Boucher B, Arden N, Godfrey K, Cooper C. the Princess Anne Hospital Study. Maternal vitamin D status during pregnancy and childhood bone mass at 9 years: a longitudinal study. Lancet. 2006; 367:36–43. [PubMed: 16399151]

Kadushin C. Social Class and the Experience of Ill Health. Sociological Inquiry. 1964; 35(1):67–80.

Kenkel D. Health Behavior, Health Knowledge, and Schooling. The Journal of Political Economy. 1991; 9(2):287–305.

Kenny David A. Reflections on Mediation. Organizational Research Methods. 2008; 11(2):353–358.

Kitagawa, E.; Hauser, P. Differential Mortality in the United States: A Study in Socioeconomic Epidemiology. Cambridge, MA: Harvard University Press; 1973.

Kogevinas M, Porta M. Socioeconomic differences in cancer survival: a review of the evidence. International Agency for Research on Cancer Scientific Publication. 1997; 138(45):177–206.

Lauderdale D. Education and Survival: Birth Cohort, Period, and Age Effects. Demography. 2001; 38(4):551–561. [PubMed: 11723951]

Lehoux P, Denis J, Rock M, Hivon M, Tailliez S. How medical specialists appraise three controversial health innovations: scientific, clinical and social arguments. Sociology of Health & Illness. 2010; 32(1):123–139. [PubMed: 19961559]

Link B, Phelan J. Social Conditions as Fundamental Causes of Disease. Journal of Health and Social Behavior. 1995; 35(extra issue):80–94. [PubMed: 7560851]

Link B, Northridge M, Phelan J, Ganz M. Social Epidemiology and the Fundamental Cause Concept: On the Structuring of Effective Cancer Screens by Socioeconomic Status. The Milbank Quarterly. 1998; 76(3):375–402. [PubMed: 9738168]

Lutfey K, Freese J. Toward some Fundamentals of Fundamental Causality: Socioeconomic Status and Health in the Routine Clinic Visit for Diabetes. American Journal of Sociology. 2005; 110(5): 1326–1372.

Lutfey K, Eva K, Gerstenberger E, Link C, McKinlay J. Physician Cognitive Processing as a Source of Diagnostic and Treatment Disparities in Coronary Heart Disease: Results of a Factorial Priming Experiment. Journal of Health and Social Behavior. 2010; 51(1):16–29. [PubMed: 20420292]

Marmot, M. The Status Syndrome. New York: Times Books; 2004.

Miech R, Pampel F, Kim J, Rogers R. The Enduring Association between Education and Mortality: The Role of Widening and Narrowing Disparities. American Sociological Review. 2011; 76(6): 913–934.

Mirowsky, J.; Ross, C. Education, Social Status, and Health. New Jersey: Aldine Transaction; 2003.

National Center for Health Statistics. Data File Documentation, National Health Interview Survey, 2009 (machine readable data file and documentation). National Center for Health Statistics, Centers for Disease Control and Prevention; Hyattsville, Maryland: 2009.

Pescosolido B. Beyond Rational Choice: The Social Dynamics of How People Seek Help. American Journal of Sociology. 1992; 97(4):1096–1138.

Osterberg L, Terrence Blaschke. Adherence to Medication. The New England Journal of Medicine. 2011; 353:487–497. [PubMed: 16079372]

Roth, Julius A. Some Contingencies of the Moral Evaluation and Control of Clientele: The Case of the Hospital Emergency Service. American Journal of Sociology. 1972; 77(5):839–856.

San Giovanni J, Parra-Cabrera S, Colditz G, Berkey C, Dwyer J. Meta-analysis of Dietary Essential Fatty Acids and Long-Chain Polyunsaturated Fatty Acids as They Relate to Visual Resolution Acuity in Healthy Preterm Infants. Pediatrics. 2000; 105(6):1292–1298. [PubMed: 10835071]

Sheila I. Dietary omega 3 fatty acids and the developing brain. Brain Research. 2008; 1237:35–43. [PubMed: 18789910]

Smedley, B.; Stith, A.; Nelson, A. Unequal Treatment: Confronting Racial and Ethnic Disparities in Health Care. Washington, DC: National Academy Press; 2002.

U.S. Bureau of the Census. Poverty Thresholds: 2010. Washington, DC: U.S. Bureau of the Census; 2010.

U.S. Department of Health & Human Services. Healthy People 2010: Understanding and Improving Health. 2. Washington, DC: U.S. Government Printing Office; 2000.

van Ryn M, Burke J. The effect of patient race and socio-economic status on physician's perceptions of patients. Social Science & Medicine. 2000; 50(6):813–828. [PubMed: 10695979]

van Ryn M, Fu S. Paved with Good Intentions: Do Public Health and Human Service Providers Contribute to Racial/Ethnic Disparities in Health? American Journal of Public Health. 2003; 93(2): 248–255. [PubMed: 12554578]

Warren J, Hernandez E. Did Socioeconomic Inequalities in Morbidity and Mortality Change in the U.S. Over the Course of the 20th Century? Journal of Health and Social Behavior. 2007; 48(4): 335–351. [PubMed: 18198683]

Research Highlights

- Advances in biomedical information can precipitate the emergence of disparities in health behaviors.
- Providers serve as a conduit for new information when they translate it into professional recommendations.
- Clinic-level protocol and provider recommendations may contribute to differences in patient decisions about health behaviors.
- Using data from a mixed-method study of pregnant women living in the United States, I explore use of two new supplements.
- The strength and uniformity of provider recommendations may prevent or exacerbate the formation of health disparities.

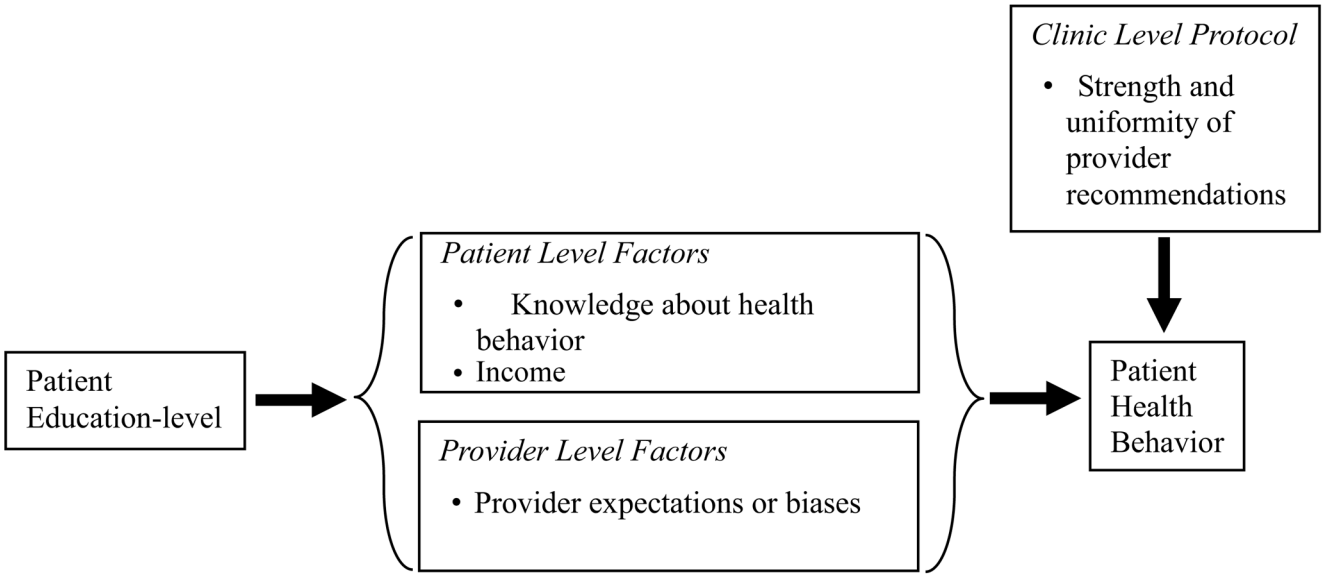

Figure 1.
Conceptual Framework of Factors Associated with the Formation of Educational Disparities in Health Behaviors

Table 1

Measures from the Health Information and Behaviors During Pregnancy Study (HIBPS)

	%/Mean	(SE)
Supplement intake		
Omega-3 fatty acid	34.1	
Vitamin D	41.8	
Supplement knowledge		
Omega-3 fatty acid (0 = 13.5%; 1 = 21.2%; 2 = 22.5%; 3 = 42.8%)	2.0	.07
Vitamin D (0 = 28.4%; 1 = 27.9%; not asked = 43.7%)	49.6	
Socioeconomic status		
Education: highest degree between couple		
Some college or less	13.0	
Bachelor's degree	31.7	
Graduate degree	55.3	
Health care provider recommendations		
Orange Clinic	76.0	
Red, Yellow and Green Clinics	24.0	
Sociodemographic characteristics		
Income: equal to or below two times the federal poverty limit	11.7	
Age	30.4	.35
White	73.1	
Black, Asian, multiple races or other	26.9	
Hispanic	4.8	
Number of weeks pregnant	18.8	.44
Partnered (married, engaged or member of an unmarried couple)	93.8	

Note: Nearly all participants ($N = 208$) are included in the final analysis.

Table 2

Logistic Regression Estimates of Omega-3 Fatty Acid and Vitamin D Supplement Intake on Education

	Omega-3 Fatty Acid				*Vitamin D*			
	Model 1a Exp(β)	**Model 2a Exp(β)**	**Model 3a Exp(β)**	**Model 4a Exp(β)**	**Model 1b Exp(β)**	**Model 2b Exp(β)**	**Model 3b Exp(β)**	**Model 4b Exp(β)**
Education: Highest Degree Between Couple								
Less than a Bachelor's degree (reference group)	–	–	–	–	–	–	–	–
Bachelor's degree	2.19	1.84	1.70	1.67	1.08	0.98	0.88	0.80
Graduate degree	3.94 **	3.16 **	2.87 *	2.82 *	1.27	1.16	1.02	0.95
Health Knowledge								
Omega-3 fatty acid knowledge (0 = low; 3 = high)		1.30 *	1.29 *	1.32 **				
Vitamin D knowledge								
knowledge						1.74 **	1.74 **	1.73 *
no knowledge or not asked (reference group)						–	–	–
Income								
Equal to or below two times the poverty level			0.63	0.70			0.65	0.69
Health Care Provider Recommendations								
Orange Clinic				1.91 *				4.59 ***
Red, Yellow, and Green Clinics (reference group)				–				–

Note: N = 208 for all models. Models also control for four demographic factors: age, race, ethnicity, and number of weeks pregnant. If women were not in a relationship (*N* = 16) their education level was used. Results are provided as odds ratios for all models. See text for further details.

* $p < 0.10$;

** $p < 0.05$;

*** $p < 0.01$ (one-tailed).